

Low Cost Test Bed Tool Development for Validation of Mission Critical Events

The Cassini Program is one of the last large interplanetary spacecraft missions. It is a joint effort between the European Space Agency, the Italian Space Agency and NASA. The U.S. portion of the mission is managed for NASA by the Jet Propulsion Laboratory (JPL). The primary mission is to survey the complex Saturnian system and release the ESA-Huygens probe at Titan. The success of the Cassini Mission has been largely due its many simulation test beds and its rigorous test program. The Integrated Test Laboratory (ITL) at the JPL is an integral part of the Cassini Program and provides hardware in the loop simulation. Pre-launch, the ITL's primary role was to validate system level architecture, subsystem flight software, ground software, and support equipment simulation software. Its present role has increasingly focused on Mission Operations Sequence testing, anomaly investigation, training and validation of mission milestones. This expanded role has led to the development of necessary analysis tools. These tools were developed quickly and at low cost given that their necessity was not foreseen during early mission planning. Several rapid development techniques and cost cutting methods were used to implement the needed tools. The methods involved were; use of freeware, use of Commercial Off The Shelf (COTS) software, and technology transfer with other Projects at JPL.

The use of freeware was an invaluable factor in the development of these tools. Freeware availability, reliability and support sped up the development cycle and subsequently cut costs. The widespread use of freeware in industry and by developers has led to mature and proven freeware. Code, concepts and help tend to also be readily available among developers at JPL and on the Internet. The freeware code used in the development of these tools included compilers, data base engines, user interfaces, and interpreters.

COTS packages were used to aid rapid development. Their use was limited to specific tasks that would have required a long time to develop independently. Experience revealed that the COTS costs were offset by the shortened development cycle. COTS packages also offered the advantage of being multi-platform and could typically export into other formats. User familiarity with the COTS packages used also decreased required training.

Technology transfer with other Projects at JPL was another technique used to shorten the development cycle and subsequent costs. The transfer involved inheritance of software and limited use of its associated expertise to aid in development. Improvements were made to the inherited software and the new tools were designed to make it possible for other projects to use them with simple modifications.

Two examples of this rapid development process are examined in detail in this paper: A pointing tool to verify performance of the Attitude and Articulation Control Subsystem during simulation runs of the Probe Relay Sequence, and a data gap analysis tool to quantify possible data losses that could occur during non-nominal Probe Mission scenarios.